

REMARKS/ARGUMENTS

The Applicant appreciates the Examiner's thorough examination of the subject application.

Claims 92, 97, 99, 101, 104, 106-109, 118, 120-123, 125-129, 151, 152, 154, and 156-165 are pending in the subject application. All of these claims were rejected on various statutory grounds in the final Office Action mailed June 11, 2009, as described in further detail below.

Claims 92, 101, 118, 120, 121, 151, and 152 are amended herein to clarify Applicant's claimed invention. No new matter has been added. In light of the foregoing amendments and the following remarks, Applicant requests reconsideration and further examination of the subject application.

Claim Rejections – 35 USC § 103

i. Claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129, and 163

Concerning items 2-12 of the Office Action, claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129, and 163 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,013,571 to Morrell ("Morrell") in view of U.S. Patent Application Publication No. US 2002/0033525 to Ohuchi ("Ohuchi"). Both references have been previously described in Applicant's previous papers for the subject application as submitted on July 21, 2008 and February 25, 2009. Reconsideration and withdrawal of the rejections are respectfully requested.

One requirement for a rejection under 35 U.S.C. § 103(a) is that the cited reference(s) must teach or suggest all of the limitations of the claim(s) at issue. Another necessary requirement for a rejection under 35 U.S.C. § 103(a) is that proper motivation must exist to combine or modify the teachings of the reference(s) in the way proposed by the Examiner. It is respectfully submitted that both of these requirements are lacking in the present situation.

A. All Claim Limitations Not Met

Independent claim 92 recites the following:

A chip package comprising:

a substrate comprising a first pad having a surface with a first region, a second region and a third region between said first and second regions, and a solder mask layer on said first and second regions, wherein a first opening in said solder mask layer is over said third region, and said third region is at a bottom of said first opening;

a silicon chip over said substrate, wherein said silicon chip comprises a second pad having a surface with a fourth region, a fifth region and a sixth region between said fourth and fifth regions and over said third region, and a passivation layer on said fourth and fifth regions, wherein a second opening in said passivation layer is under said sixth region, and said sixth region is at a top of said second opening;

a copper pillar between said third region and said sixth region, wherein said copper pillar is connected to said third region through said first opening and to said sixth region through said second opening, wherein said second pad is connected to said first pad through said copper pillar;

a metal layer between said copper pillar and said sixth region, between said copper pillar and said passivation layer, between said copper pillar and said fourth region, and between said copper pillar and said fifth region, wherein said copper pillar is connected to said sixth region through said metal layer; and

a tin-containing layer between said copper pillar and said third region, wherein said copper pillar is connected to said third region through said tin-containing layer, wherein said tin-containing layer comprises silver, **wherein said copper pillar has a thickness greater than a distance between said copper pillar and said third region**.

[Emphasis added]

Independent claim 120 as amended recites the following:

A bonding structure on a chip comprising a pad having a top surface with a first region, a second region and a third region between said first and second regions, and a passivation layer on said first and second regions, wherein an opening in said passivation layer is over said third region, and said third region is at a bottom of said opening, comprising:

a metal layer on said third region, over said passivation layer and over said first and second regions, wherein said metal layer is connected to said third region through said opening;

a copper pillar on said metal layer, over said passivation layer and over said first, second and third regions, wherein said copper pillar is connected to said third region through said metal layer; and

a tin-containing cap over said copper pillar, wherein said tin-containing cap is connected to said copper pillar, wherein said tin-containing cap comprises silver, **wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar.**

[Emphasis added]

Amended independent claims 92 and 120 recite “**wherein said copper pillar has a thickness greater than a distance between said copper pillar and said third region**” and “**wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar,**” respectively.

Neither Morrell nor Ohuchi are seen as teaching such limitations. The Examiner admits as much in the Office Action, regarding previously presented claim 122.

Moreover, for the rejection of independent claim 92, the Examiner contends that Morrell teaches all of the Applicant’s recited limitations except that Morrell does not appear to show explicit use of a solder mask or that its tin cap includes silver or copper. Ohuchi is then cited as teaching such. Applicant respectfully disagrees and submits that the cited references are not understood as teaching “a solder mask layer on said first and second regions, wherein a first opening in said solder mask layer is over said third region, and said third region is at a bottom of said first opening.” .

The solder mask (or solder resist) taught by Ohuchi is not applied to any portion of the electrode portions on the substrate. In fact, the specific portion of Ohuchi cited by the Examiner (paragraph [0079]) states such: “On the substrate surface employed in this embodiment, **except electrode portions, a solder resist 11 is coated to protect the substrate surface.**” [Emphasis added] Paragraph [0043] of Ohuchi states even more clearly that “[o]n the substrate surface, **except the electrode section,** a solder resist is formed.” The drawings of Ohuchi further corroborate this bare electrode configuration. See, e.g., Ohuchi, FIGS. 3A and 5.

Accordingly, the combination of Morrell and Ohuchi fails to teach or suggest all of the limitations of claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129, and 163.

B. Proper Motivation is Not Present

As stated above, amended independent claims 92 and 120 respectively recite “**wherein said copper pillar has a thickness greater than a distance between said copper pillar and said third region**” and “**wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar.**”

Neither Morrell nor Ohuchi are seen as teaching such limitations. The Examiner is believed to have admitted as much in the Office Action, regarding previously presented claim 122 (see item 11 of the Office Action). In an attempt to provide motivation, the Examiner cites *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955) and other cases for the contention that mere dimensional limitations are *prima facie* obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.

Applicant traverses such a contention and notes that paragraph [0040] of the published application (U.S. Patent Publication No. US 2003/0127734) states that such a limitation on the outer diameter (or “transverse dimension”) provides that “pitch between neighboring bond pads on a chip can be further reduced.” Such a limitation, it is submitted, provides the unobvious result of **decreasing pitch between bond pads.**

Thus, Applicant submits that proper motivation does not exist to combine or modify Morrell and Ohuchi in the way proposed by the Examiner to achieve amended independent claims 92 and 120.

Moreover, as was described previously, Ohuchi is seen as teaching away from covering any portion of substrate electrodes with solder resist, e.g., as recited in independent claim 92 and its dependent claims. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). Thus, it is respectfully submitted that proper motivation is lacking and that, in formulating the

rejection, the Examiner may have engaged in hindsight analysis, i.e., to a degree not allowed by the holding of *In re McLaughlin* 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971).

C. Conclusion

For at least the foregoing reasons, Applicant respectfully submits that Morrell and Ohuchi form an improper basis for a rejection of claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129, and 163 under 35 U.S.C. § 103(a). Applicant accordingly requests that the rejection be withdrawn and the claims allowed.

Claims 99 and 165

Concerning items 13-16 of the Office Action, claims 99 and 165 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell and Ohuchi, as applied to claims 92 and 120, and in further combination with U.S. Patent Application No. US 2002/0079575 to Hozoji et al. (“Hozoji”). Applicant traverses the rejection and requests reconsideration.

Without acceding to the statements made by the Examiner for the rejection, Hozoji is cited for teaching the use of bumps of tin containing copper to mount chips. Hozoji, however, is not understood as teaching the deficiencies of Morrell and Ohuchi relative to independent claims 92 and 120, which are the base claims for claims 99 and 165, respectively. Accordingly, claims 99 and 165 are patentable for at least the same reasons as independent claims 92 and 120.

Claims 108 and 125

Concerning items 17-20 of the Office Action, claims 108 and 125 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell and Ohuchi, as applied to claims 92 and 120, and in further combination with U.S. Patent Application No. US 2002/0095784 to Fang (“Fang”). Applicant traverses the rejection and requests reconsideration.

Without acceding to the statements made by the Examiner for the rejection, Fang is cited for teaching the use of a chromium metal layer. Fang, however, is not understood as teaching the deficiencies of Morrell and Ohuchi relative to independent claims 92 and 120, which are the base

claims for claims 108 and 125, respectively. Accordingly, claims 108 and 125 are patentable for at least the same reasons as independent claims 92 and 120.

Claims 151-152, 154, 157, 159-162, and 164

Concerning items 21-24 of the Office Action, claims 151-152, 154, 157, 159-162, and 164 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell, described previously.

Independent claim 151 recites, among other things, **“wherein said tin-containing cap has a greatest transverse dimension less than that of said copper pillar.”**

As was explained previously with regard to the rejections of claims 92, 97, 101, 104, 106, 107, 109, 118, 120-123, 126-129, and 163, Morrell fails to teach such a limitation. Accordingly, claims 151-152, 154, 157, 159-162, and 164 are patentable for at least the same reasons as independent claims 92 and 120. Consequently, Applicant requests withdrawal of the rejection accordingly.

Claim 156

Concerning items 25-28 of the Office Action, claim 156 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell, as applied to claim 151, and in further combination with Fang, described previously.

Without acceding to the statements made by the Examiner for the rejection, claim 156 is patentable for at least the reason of its dependence upon claim 151. Fang is cited for teaching the use of a chromium metal layer. As was noted previously, however, Fang is not understood as teaching the deficiencies of Morrell. Accordingly, claim 156 is believe to be patentable over Morrell and Fang. Consequently, Applicant requests withdrawal of the rejection.

Claim 158

Concerning items 29-32 of the Office Action, claim 158 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell, as applied to claim 151, and in further combination with Hozoji, described previously.

Without acceding to the statements made by the Examiner for the rejection, Hozoji is cited for teaching the use of bumps of tin containing copper to mount chips. Hozoji, however, is not understood as teaching the deficiencies of Morrell relative to independent claim 151, which is the base claim for claim 158. Accordingly, claim 158 is patentable for at least the same reasons as independent claim 151. Consequently, Applicant requests withdrawal of the rejection.

Claim 161

Concerning items 33-36 of the Office Action, claim 161 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrell, as applied to claim 151, and in further combination with Ohuchi, described previously.

Without acceding to the statements made by the Examiner for the rejection, claim 161 is believed to be patentable for at least its dependence upon claim 151. Accordingly, Applicant requests withdrawal of the rejection.

CONCLUSION

In light of the Amendments and Remarks herein, Applicants submit that the claims are now in condition for allowance and respectfully request a notice to this effect. Should the Examiner have any questions, he/she is invited to call the undersigned.

Attached is a Request for Continued Examination and a Petition for a Two-Month Extension of Time under 37 C.F.R. § 1.136. The Commissioner is hereby authorized to charge \$1300 (\$810 for the Request for Continued Examination and \$490 for the Petition for Extension of Time) to Deposit Account 502624. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 502624 and please credit any excess fees to such deposit account.

Respectfully submitted,
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